

NSR-21-002-179  
University of Maryland

INNOVATION IN LEARNING ABOUT DECISION MAKING:  
THE NASA SUMMER INSTITUTE

FACILITY FORM 802

N69-75422

(ACCESSION NUMBER)

14

(PAGES)

CR-103739

(NASA CR OR TMX-OR AD NUMBER)

(THRU)

None

(CODE)

(CATEGORY)

INNOVATION IN LEARNING ABOUT DECISION MAKING: THE NASA  
SUMMER INSTITUTE

With the Goddard Space Flight Center as the laboratory and twenty five upper division university students as the participants the "Summer Institute of Public Administration" was launched in the summer of 1968 as an experiment in the effectiveness of learning about decision making in research and development in the real environment. The conceptualization of the program for the Institute developed in an evolutionary and pragmatic fashion. The proposal for the contract between the University of Maryland and the National Aeronautic and Space Administration was based on discussions between university representatives and NASA officials.<sup>1</sup> Both parties recognized the opportunity to explore the innovative approaches to decision making used by NASA and the potential value to public administration of the results of direct student observation, study, and dialogue with actual decision makers.

Widespread criticism of traditional teaching techniques by students, faculty and the public of traditional teaching techniques unrelated to student's needs and experience in the "real world" have stimulated searches for new learning techniques. The value of student involvement in the situational environment was tested by the Institute approach.

#### Selection of Students

Initially all participants were to be selected on the basis of applications received from interested qualified students screened by NASA and representatives of the University of Maryland, however, the late inauguration of the program forced the adoption of a supplementary recruitment method. The U. S. Civil Service Commission provided a list of students who had taken the Federal Summer Entrance Examination and seventeen of the twenty-five students were selected

from this list. The students selected were juniors and seniors who had at least one course in political science and were majors in social science or business administration with a B average or above. Enrollees represented a wide geographical range from the University of New Mexico to Saint Lawrence University.<sup>2</sup> Each student was enrolled in an undergraduate seminar in Public Administration and received three hours credit. In addition to this academic credit stipends covering tuition books and transportation expenses were provided by NASA. Students depending on summer employment as a source of income for payment of expenses for the regular academic year were to work at Goddard Space Flight Center for the summer period after the end of the Institute.

#### OBJECTIVES OF THE PROGRAM

Innovation and experimentation are a part of NASA environment and the program concept and objectives were purposefully developed to explore new techniques for improving education in public administration. Traditional and orthodox organization and methodology consequently were ignored in establishing objectives and devising techniques to achieve goals. Utilization of the Goddard Space Flight Center as the base for both academic and organizational aspects of the Institute provided a "real world" environment for studying decision-making theory and practical problems in a bureaucratic setting.

Three broad objectives were established for the Summer Institute:

1. To provide students with knowledge and skills necessary for making and evaluating decisions in a Government Research and Development environment in one or more of the following areas:

- A. Administrative Management
- B. Project Management
- C. Human Resources Management
- D. Financial Management
- E. Procurement Management

II. To influence colleges and universities to develop and teach courses or course segments related to management of Government Research and Development organizations and to emphasize public administration application in existing courses.

1. To provide broader dissemination of information in Government Research and Development management to academicians.

2. To increase the interest of students' in Government Research and Development problems through the Summer Institute.

III. To evaluate the potential of the use of NASA Centers as "Laboratories" for the study of Research and Development administration.

- 1. Evaluate in-house effectiveness of the Summer Institute in stimulating meaningful research into problems in Research & Development Management.
- 2. Obtain student evaluations of the Institute as an educational device.
- 3. Obtain faculty evaluations of the Institute as a supplement to a curriculum in public administration.
- 4. Make recommendations based on the above evaluations for organization and implementation of future study programs of this type.

#### THE EDUCATIONAL PROCESS

Five components were selected as the principal vehicles for implementing the program: an academic seminar, formal lectures, research projects, simulation exercises in decision-making and visits to selected NASA installations. Although a systems approach was not used to integrate these components their inter-

relatedness was a central aspect of the Institute.

Students participating in the program were involved in a formal schedule which began at 8:15 in the morning and ended at 4:30 in the afternoon. The academic seminar occupied the first two hours and the formal lectures and discussion another hour and one-half of the pre-noon period. The afternoon was set aside for work on research projects for the four weeks period with the exception of two Friday afternoons which were devoted to oral reports on projects. Students participated in Gremex (Goddard Research and Engineering Management Exercise), a Research and Development Management Simulation Exercise in decision making each afternoon for one week.<sup>3</sup>

#### THE SEMINAR

The Seminar was titled: The Nature and Concepts of Organizational Decision-Making and was outlined as follows:

- I. The Societal Environment
  - A. Pluralist Democratic Government
  - B. Corporate capitalist economic organization
  - C. Social class mobility
  - D. Interlocking economic, social, and political power centers
- II. The Environment of Public Organizations
  - A. External forces with direct impact
  - B. Internal components affecting organizational development
- III. Concepts of organizational decision making
  - A. The administrative process as the total concept
  - B. Theories: abstract and empirical
  - C. Principles common to large and small organizations

#### IV. The Process of Decision-Making

- A. Art or science?
- B. Constraints in public bureaucracies
- C. The role of formal and informal leadership
- D. Group relationships
- E. Consent and authority

The textual materials selected covered:

1. The general field of public administration. (2) a basic presentation of behavioralist decision-making theory (3) analyses of the nature of bureaucratic organizations; (4) the process of decision making in a large public organization. (5) a critical analysis of decision-making in research and development in federal agencies. Students were given weekly assignments from these materials.<sup>4</sup>

The instructor conducted the seminar informally giving few lectures and limiting his participation to short explanatory and provocative statements. Individual reading assignments on selected topics were made to insure participation by all students. Following brief reports these topics were discussed in considerable detail. After the first ten days of the seminar a written exercise was conducted in which the students related the concepts and principles they had derived from the text materials to their research project as they perceived the project at that point in time.

#### FORMAL LECTURES

Most of the formal lectures were given by top level personnel of the Goddard Space Flight Center. Others participating were from NASA Headquarters, U.S. Civil Service Commission, Government Accounting Office, Bureau of the Budget, Counsel for the House of Representatives Committee on Science and Astronautics the Executive Director of the American Society of Public Administration and a representative of the

contractor for the Goddard Health Center. A brief discussion period followed each of the lectures.

### RESEARCH PROJECTS

Topics for projects were selected by NASA personnel on the basis of actual "live" problems. They were in the areas of: Administrative Management Decision Projects; Project Management Decision Projects; Human Resources Decision Projects; Financial Management Decision Projects and Procurement Management Decision Projects. Students selected topics on an individual or team basis. Each research project had a NASA adviser who was working in the subject matter area of the project. The students met as often as possible with their project advisers and obtained their guidance in the technical phases of their research.

At the end of the five week period two afternoons were set aside for oral evaluation reports on each project. When possible advisers attended these evaluation sessions and offered criticisms and suggestions. All of the students had an opportunity to participate in the discussion of each project.

### GREMEX

Gremex, the Research and Development Management Simulation Exercise, was the tool used to introduce students to sophisticated techniques in decision making. As a new teaching technique students were instructed how to play this game to obtain experience in Research and Develop project management and through prediction anticipate events.

### VISITS TO NASA HEADQUARTERS AND INSTALLATIONS

To obtain an overall view of NASA operations a schedule of visits was organized as an integral part of the students experience in the Institute. The first trip was to the Washington Headquarters where the students were thoroughly briefed on the role of the central office by high staff officials in the NASA program. In the final week

of the program visits were made to three installations: Wallops Island, Langley Field, and John F. Kennedy Space Center.

During the visit to Wallops Island the students were briefed on the operation of this launching station for small vehicles and shown the launch sites. The external administrative problems involved in managing a remote station were thoroughly covered with emphasis on the difficulties in recruiting and retaining personnel. The significance of the relationship of the installation to the community was stressed.

The visit to Langley Field NASA Research Center offered the opportunity to observe a demonstration of sophisticated research equipment. The charts and movies with commentaries by principal management, scientists, and engineering research personnel portrayed the practical application of the research. The international activities of the program added an exciting aspect to the role of the Research Center.

While Langley Research Center was fascinating and educational, it could not match the impact of the John F. Kennedy Space Center. The students toured the tremendous expanse of the Center and viewed the numerous complexes for launching and testing space craft: Saturn I, Gemini, Titan, Mercury Atlas, Centaur, and <sup>the</sup> Space Museum. A tour was taken of the huge building housing the test facilities for the Apollo with a comprehensive explanation of the operational functioning of this facility. Following the tour they were briefed on unmanned launch operations by a NASA official. Mr. Albert F. Siepert, Deputy Director, Center Management who was in charge of organizing, managing, and directing the operations of the Center conducted two lectures and discussion periods which were important to the objectives of the Institute.



## EVALUATION OF THE INSTITUTE

The students, NASA personnel, and the author, the three parties participating in the Institute, all share a common interest in arriving at a judgement on the success of the program. The students occupied the most strategic vantage point for judging the overall educational impact of the experiment. As a part of an attempt to evaluate, they were given a questionnaire on their last day which offered an opportunity to rate the components in the Institute. Students did not sign the questionnaire so the maximum objectivity was possible. The questionnaire was not pretested; consequently it was not infallible. Weaknesses were revealed in its application. One weakness was the failure of the questionnaire to give separate attention to the installation visits. The other outstanding weakness was the failure to explicitly instruct the students to use comparisons in every section as the criterion for rating. Most of the respondents used the comparative approach. Unfortunately, some rated more than one of the components 1, 2, or 3, which made the results mathematically and scientifically inaccurate. Nevertheless, the results of the questionnaires offer a rough indication of the students view of the Institute, so they deserve a prominent place in the evaluation.

## ANALYSIS OF SUMMARY OF STUDENT RATINGS

Table I, Part I, Summary of Student Ratings is the most significant index of their evaluation of the various components of the Institute. Here they clearly gave the most first places (13) to Gremex, indicating that they regarded this exercise as a significant contribution to their understanding of the decision making process. The students were also invited to make general comments on the back of the questionnaire sheet. In their comments several

stated that more time should have been devoted to Gremex. Research Projects was the runner up to Gremex in their assessment with (6) first place votes. Formal Lectures with (4) indicated that they preferred the pragmatic operational approach to decision making as most of the formal lecturers were NASA officials. The Academic Seminar was given the lowest rating by the students who indicated they were not especially attracted by the abstract theory of decision making as presented in the text materials.

Ratings of "Interaction with fellow students" with three firsts and five second places was a surprisingly low score as opportunities for exchanges were frequent. A higher score was given to "Informal Environmental Inputs" yet with three first places it ranked only slightly above the interaction component.

In the rating of components in the academic seminar as reflected in Table I text materials were rated by far as the least effective factor with only two first places and 11 last place ratings. Oral reports were also given an extremely low rating: two first places, eleven third places, and seven fourth places. Instructors statements were given next to the highest rating (discussion receiving the highest) with 3 first places and fifteen second places. Rating of components of the Formal Lectures revealed that discussion again was rated highest of the two identifiable factors in this aspect of the program.

Ratings of part IV which concerned the Research Project gives the "Guidance of the Adviser" the top rating, 13, with the Students Research Experience 12, a close second. The "Evaluation Discussion" was poorly regarded by the group as only three members rated it first. (As the sum of these ratings is larger than 25, it does not represent true comparability).

In the Gremex program the "Experience" was given the highest rating of any component (23).

Part IV "Interaction with Colleagues" reflects the low regard the students had for their formal discussions. Sharing common experiences in research ranks highest in impact with 12 first places. Informal exchanges is a close runner up (10).

In assessing the effect of Informal Environment on their learning process, "Dialogue with NASA Personnel" received one more vote, 13, than the two other components "Visual Observations" and "Psychological Climate." The last factor received the most third choice ratings, which was the lowest for Section VII.

The results reflected in Table II entitled the Highest and Lowest Ratings For Part I reinforce the assessment given in the examination reported in Table I. Gremex with the "Highest Double Combination" 21 (1 + 2). As in Table I this is followed by "Instructors statements" with 20 (2 + 3) combination preferences. Over half the students rate text materials 4th and almost one third rate Oral Reports as 4th. Only one student places "instructors statements" in the last category.

Data in Tables IV, V and VI are self evident and merely reinforce the conclusions derived from Table I.

#### GENERAL EVALUATION AND CONCLUSIONS

Student evaluative reactions may not have provided ideal empirical data but their rough assessments are an expression of judgment on the strength and weakness of the Institute. With their inputs in mind the author will attempt to assess the Institute in terms of achieving the stated objectives.

Objective number I "to provide students with knowledge and skills necessary for making and evaluating decisions in a Government Research and Development environment in one or more of the

following areas:

- A. Administrative Management
- B. Project Management
- C. Human Resources Management
- D. Financial Management
- E. Procurement Management.

In the short space of six weeks achievement of this objective would be difficult, if not impossible, if all of the areas were covered. Fortunately, primary emphasis was placed only in the area pertaining to the students Research Project and, to a considerable extent, in the authors opinion this objective was reached.

The objective stated in II "to influence colleges and universities to develop and teach courses or course segments related to management of Government Research and Development organizations or to emphasize public administration applications in existing courses.

1. Provide for broader dissemination of information to academic people on Government Research and Development Management.
2. Increase interest of students in Government Research and Development problems through the Summer Institute.

The introductory statement "to influence colleges etc. is impossible to measure at this time. Future events will in large measure determine the impact of the Institute on the academic curriculum. The publication of the evaluative report and its wide dissemination may have the effect of encouraging the academic community to develop new courses and revise existing courses so they will be concerned with Research and Development Management.

Sub-objective 2 "to increase interest etc." has unquestionably been achieved. A high percentage of the twenty five students attending the Institute have been interested and they will probably communicate this interest to many fellow students.

The realization of the objective stated in III "To evaluate the potential of the use of NASA Centers as laboratories for study of Research and Development administration" can be achieved. Student response to the evaluation questionnaire strongly favored the NASA Center as a "laboratories" for study. Student work on research projects, their stimulating new experiences in the research and development environment, has without question, sharpened interest in research in administration. Likewise, the ratings on the questionnaires gave strong support to the Institute as an educational device.

One objective, "faculty evaluations of the Institute as a supplement to curriculum," has not yet been achieved. Except for the author academicians have not had an opportunity to evaluate the Institute. In my opinion an Institute type activity is a viable vehicle for supplementing the public administration curriculum.

#### RECOMMENDATIONS FOR FUTURE STUDY PROGRAMS

The general conclusion was that the format of the Institute is a feasible vehicle and should be continued. However, certain improvements are suggested as follows:

1. Development of the program-planning for the Institute should begin early so that screening and recruiting of students could be completed by April 1.

2. Ideally, all students selected should have the introductory course in Public Administration and one course in calculus. At a

minimum they should have the introductory course. If the students had a solid mathematical background more appropriate text materials could be utilized.

3. At least two additional days should be allotted to playing Gremex as the students reaction indication that they profited tremendously from this activity.

4. Two or three formal lectures should be deleted from the schedule and the additional time should be devoted to collective evaluation of the students research project.

5. Students should be required to submit an outline of their project for approval by the academic instructor and the project adviser prior to beginning the project research. If at all feasible research project advisers should attend the project evaluation session.

6. Installation visits -- these should take place before the last week so the experience could contribute to other activities.

7. A period should be set aside on the last day so representative NASA personnel, the academic representative and students could discuss means of improving the Institute.

Federal programs in research and development are geographically located in the major regions of the nation. Billions of tax dollars are spent on research and in innovative management of these scientific-engineering projects. Transmission of the skills and experience derived from administration in this field can be effectively aided by the laboratory type institute. Utilization of this method of teaching should help bring public administration and science management to greater numbers of future leaders.

--TABLE 1 - SUMMARY OF STUDENT RATINGS--  
EVALUATION QUESTIONNAIRE ON "DECISION MAKING" PROJECT

I. Rate the following major components in terms of their comparative overall value to your knowledge of the decision making process: (Circle the number)						
	1	2	3	4	5	6
Academic Seminar	(1)	(2)	(10)	(5)	(2)	(4)
Formal lectures (guests)	(4)	(5)	(8)	(3)	(2)	(2)
Research project	(6)	(11)	(5)	(0)	(2)	(0)
Gremex	(13)	(8)	(3)	(0)	(0)	(0)
Interaction w/ fellow students	(3)	(5)	(3)	(5)	(4)	(4)
Informal environmental inputs	(3)	(9)	(3)	(2)	(3)	(4)
II. Rate the components of the academic seminar:						
	1	2	3	4		
Text materials	(2)	(2)	(9)	(11)		
Oral reports	(2)	(4)	(11)	(7)		
Instructors statements	(3)	(15)	(5)	(1)		
Discussion	(10)	(6)	(6)	(2)		
III. Rate the components of the formal lectures:						
	1	2				
Lecture	(10)	(14)				
Discussion	(14)	(10)				
IV. Rate the components of your Research Project:						
	1	2	3			
Guidance of adviser	(13)	(6)	(6)			
Research	(12)	(12)	(1)			
Evaluation discussion	(3)	(10)	(12)			
V. Gremex:						
	1	2				
Instruction	(10)	(14)				
Experience	(23)	(1)				
VI. Interaction with colleagues:						
	1	2	3			
Formal discussions	(1)	(13)	(9)			
Informal discussions	(10)	(8)	(5)			
Project activity	(12)	(10)	(1)			
VII. Informal environment:						
	1	2	3			
Dialogue with NASA personnel	(13)	(10)	(1)			
Visual observations	(12)	(9)	(3)			
Psychological climate	(12)	(6)	(6)			

TABLE II - HIGHEST AND LOWEST RATINGS FOR PART I

	<u>Highest Double Combination</u>	<u>Lowest Double Combination</u>	<u>No. 1 Rating</u>	<u>No. 6 Rating</u>
Academic Seminar	3 + 4 (15)	1 + 2 (3)	(1)	(4)
Formal lectures	2 + 3 (13)	5 + 6 (4)	(4)	(2)
Research project	1 + 2 (17)	4 + 5 (2)	(6)	(0)
Gremex	1 + 2 (21)	4,5,6 (0)	(13)	(0)
Interaction with fellow students	4 + 5 (9)	No low double all 3 same	(3)	(4)
Informal environmental inputs	2 + 3 (12)	3 + 4 (5)	(3)	(4)

TABLE III - HIGHEST AND LOWEST RATINGS FOR PART II

	<u>Highest Double Combination</u>	<u>Lowest Double Combination</u>	<u>No. 1 Rating</u>	<u>No. 4 Rating</u>
Text materials	3 + 4 (11)	1 + 2 (4)	(2)	(11)
Oral reports	3 + 4 (18)	1 + 2 (6)	(2)	(7)
Instructors statements	2 + 3 (20)	3 + 4 (6)	(3)	(1)
Discussion	1 + 2 (16)	3 + 4 (8)	(10)	(2)

TABLE IV - HIGHEST AND LOWEST RATINGS FOR PART IV

	<u>1st Rating</u>	<u>2nd Rating</u>
Guidance of adviser	(13)	(6)
Research	(12)	(12)
Evaluation discussion	(3)	(10)

TABLE V - HIGHEST RATINGS FOR PART VI

Formal discussions	(1)
Informal Discussions	(10)
Project activity	(12)

TABLE VI - HIGHEST RATINGS FOR PART VII

Dialogue w/NASA Personnel	(13)
Visual observations	(12)
Psychological climate	(12)



## Footnotes

<sup>1</sup>The principals representing NASA were Dr. Arthur L. Levine, Executive Officer for Goddard Institute for Space Studies and Dr. Michael J. Vaccaro, Assistant Director of Administration and Management, Goddard Space Flight Center, and Mr. Charles F. Bingmen, Special Assistant to the Associate Administrator for Organization and Management, NASA Health Quarters, Dr. Conley H. Dillon, Professor of Government and Politics, University of Maryland, Mr. John V. Sharp, University College and Dr. James H. Wolfe, Associate Professor of Government and Politics, University of Maryland.

A program pamphlet entitled Summer Institute in Public Administration, July 1, 1968 - August 9, 1968 (sponsored by NASA Goddard Space Flight Center) described all elements of the program with titles of research projects and subjects and names of lectures.

<sup>2</sup>The institutions represented were: Alma College, American University, Bethany College, Cornell University, Duquesne University, Niagara University, Ohio Wesleyan University, Oklahoma State University, St. Johns College of Annapolis, St. Lawrence University, State University of New York, University of Maryland, University of New Mexico and the University of North Dakota.

<sup>3</sup>This gaming exercise was developed for use at Goddard by Dr. Michael J. Vaccaro and has proven to be very successful.

<sup>4</sup>The Materials utilized were as follows:

Anthony Downs, Bureaucratic Structure, and Decision Making Santa Monica; The Rand Corporation, 1966.

Anthony Downs, Inside Bureaucracy. Boston: Little Brown and Co., 1967.

Footnotes Cont'd.

Maurice O'Donnell. Readings in Public Administration. Boston: Houghton Mifflin Co., 1966.

Herbert A. Simon. Administrative Behavior. New York: The MacMillan Co., 1947.

Federal Research and Development Programs: The Decision Making Process. Comments by the National Academy of Sciences and the Bureau of the Budget (8th Committee on Government Operations, 90th Congress, 1st Session, House Report No. 614, August 28, 1967.)